Achromatic Vector Vortex Waveplates for Coronagraphy, Phase I

Completed Technology Project (2011 - 2011)

Project Introduction

Diffractive waveplates are optical components made of thin films of anisotropic materials by modulating their optical axis orientation in the plane of the waveplate. The family of diffractive waveplates wherein this modulation is axially symmetric ⬌ vector vortex waveplates (VVWs) ⬌ impart a spiral phase modulation at a light beam propagated through the waveplate. As a result, the intensity of radiation is sharply decreased at the axis of the beam by many orders of magnitude, depending on the topological charge and quality of the VVW. Such transparent phase components can be successfully employed in coronagraphy allowing imaging of exoplanets at diffraction angle limit of their separation from the bright host star using small aperture telescopes, and they will allow increasing the imaging capability of large telescopes. To achieve this potential, VVWs shall possess with negligibly small singularity size (~ 2 micrometer) and be spectrally broadband in a large aperture (~ 25 mm). We propose to prove the feasibility of developing such components based on azobenzene photoalignment materials, liquid crystal polymers, and the optical printing technology that employs linear-to-axial polarization conversion. This feasibility will be proven in the Phase 1 by demonstrating achromatic VVWs in 700-900 nm spectral range and <10 micrometer singulary size.

Primary U.S. Work Locations and Key Partners

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Organizations Performing Work	Role	Type	Location
BeamCo	Lead Organization	Industry Women-Owned Small Business (WOSB)	
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations	
California	Florida

Project Transitions

February 2011: Project Start

September 2011: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140204)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

BeamCo

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Nelson Tabirian

Co-Investigator:

Nelson Tabirian

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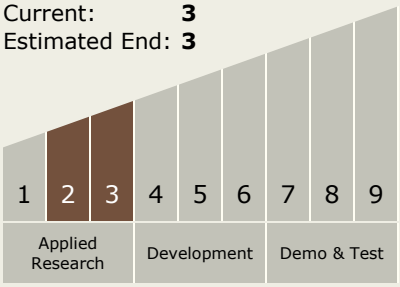
Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.2 Observatories
    - TX08.2.1 Mirror Systems

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System